A Comparison of the Results in Barber, Odean, and Zhu (2006) and Hvidkjaer (2006)

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September 2006

Barber, Odean and Zhu (BOZ, 2006) and Hvidkjaer (2006) construct portfolios based on the relative frequency of small buyer- and seller-initiated transactions on the NYSE, Amex and Nasdaq. Both studies find that stocks with small-trade selling pressures over the prior year outperform those with buying pressures. Hvidkjaer (2006) finds a similar pattern for one month returns using trading imbalances measured over the prior one month. By contrast, BOZ (2006) find the opposite pattern for one week returns using trading imbalances measured over the prior one week, namely that stocks with past small-trade buying pressures outperform those with selling pressures. The short-term results are not necessarily contradictory, but certainly worthy of further scrutiny. The purpose of this note is to reconcile the two results. Using the imbalance measure in Hvidkjaer (2006) for the analysis at the one-week level, we find qualitatively identical results to those reported in BOZ (2006). However, the measure in Hvidkjaer (2006) produces a faster reversal from initially high to subsequent low returns for the buying pressure portfolio. We find that differences in small-trade volume between the measures in BOZ (2006) and Hvidkjaer explain this faster reversal. Once we control for small-trade volume, we find very similar results at the one-month level using the two measures.

I. Methods employed

The methods employed differ in three main respects. First, the measure of order imbalances differs between the two papers. BOZ (2006) construct the measure as the proportion of signed small trades that are buys (proportion buyer-initiated trades - PB), while Hvidkjaer (2006) uses signed small-trade share volume and constructs the measure as the shares bought less shares sold divided by shares outstanding (signed small trade turnover - SSTT). Secondly, BOZ (2006) define small trades as those with values less than $5,000 in 1991 constant dollars. Hvidkjaer (2006) defines small trades by using different dollar cutoffs for size quintiles (ranging from $3,400 for small firms to $16,400 for large firms). These dollar cutoffs are converted to share cutoffs for each firm by taking the ratio of the dollar cutoff to share price at the end of the prior month and rounding the result to the nearest round lot. Thirdly, both papers sign trades using a variation of the algorithm suggested by Lee and Ready (1991). The two papers use

identical algorithms for NYSE and Amex trades. For Nasdaq trades, BOZ (2006) use the tick rule for trades inside the most recently posted quote, while other trades are signed using the midpoint of the quotes. In contrast, for Nasdaq trades Hvidkjaer (2006) uses the tick rule for trades at the midpoint of the most recently posted quote and the quote midpoint for all other trades. Despite of these differences, the trading imbalance measures are quite similar, and indeed the rank correlation between the two measures is 0.71. Therefore, we might expect the returns to portfolios constructed based on these measures also to be similar. The next section confirms this.

II. Return analysis

In table 1, we present the monthly four-factor alphas for portfolios formed using a one week formation and one week holding period using the order imbalance measures employed in both papers. The table shows results for portfolios based on both small- and large-trade imbalances. Hvidkjaer (2006) analyzes only small-trade imbalances, but for the purpose of the current note, large-trade volume was computed based on trades larger than twice the cut-off point for small trades, and a signed large-trade turnover measure was constructed.

The PB and SSTT measures yield very similar results. Panel A shows that returns are positively related to small-trade imbalance in the week of the trade and Panel B shows that small-trade imbalances continue to be positively related to return over the subsequent week. Using the SSTT measure, the average monthly risk-adjusted return of the portfolio based on small-trade buying pressures over the prior week and held for one-week is 0.719%, while that of the portfolio with prior week selling pressures is -0.296%, yielding a return differential of 1.015% per month (*t*-statistic = 4.43). Similarly, using the PB measure, the return differential between the small-trade buying and selling pressure portfolios is 1.370% per month (*t*-statistic = 6.55). By contrast, while the large trade imbalance also is positively related to returns in the week of the trade, it is negatively related to returns in the subsequent week. Using the signed turnover measure, the subsequent week return differential between the portfolios with large-trade buying and

selling pressure is -0.902% per month (*t*-statistic = -4.55). Using the PB measure for large trades, the return differential is -0.782% per month (*t*-statistic = -5.54).

The analysis so far show that the one week results using SSTT are almost identical to the one-week results in BOZ (2006). How about at the one-month level? Hvidkjaer (2006) finds that the monthly returns of stocks with buying pressures over the past one month are significantly lower than those with past selling pressures. The second column of Table 2, Panel A shows this result: The average risk-adjusted returns of stocks with past buying pressures is 0.45% per month (*t*-statistic = 1.98) lower than the returns of stocks with past selling pressures. By contrast, the second column of Table 2, Panel B shows no return differential when sorting on past one-month PB. In other words, the measure in Hvidkjaer (2006) produces a faster reversal from initially high to subsequent low returns for the buying pressure portfolio. We confirm this result by estimating estimate weekly Fama-MacBeth cross-sectional regressions of weekly returns (dependent variable) and lags of order imbalance (and other control variables). The results of this analysis are presented in Figure 1. The two measures yield qualitatively similar results, but reversals appear sooner (in week 3 rather than weeks 5 to 8) and are generally stronger using the signed small trade turnover (SSTT) measure of order imbalance.

The question then remains why does SSTT produce faster reversals in returns than does PB? In contrast to SSTT, which requires a heavy trade imbalance in small trades relative to shares outstanding, PB can register a heavy trade imbalance if there are few small trades but all of these trades are in the same direction. We suspect this difference explains the lack of reversal at a one-month horizon using PB.

To investigate this conjecture, we control for differences in small-trade turnover by further partitioning stocks based on small trade turnover, defined as the sum of the value of signed small trades (regardless of initiation) divided by market capitalization. Low small trade turnover is defined as stocks in the bottom 30% of small trade turnover in a month, while high small trade turnover is defined as stocks in the top 30% of small trade turnover. All other stocks are classified as medium small trade turnover.

The results of this analysis are presented in Table 2. The portfolios based on SSTT and PB exhibit very similar returns within each of the small-trade turnover groups. Consistent with our conjecture, we observe sharp reversals using both PB and SSTT at

the one month horizon for stocks with high levels of small trade turnover. While stocks with low or medium low trade turnover exhibit no reversals at a one month horizon, stocks with high small trade turnover earn a reliably negative return spread of 1.535 percentage points per month (*t*-statistic = 3.69) using PB and 1.381 percentage points *(t*-statistic = 4.57) using SSTT.

III. Conclusion

Though BOZ (2006) and Hvidkjaer (2006) use slightly different methods to sign trades, identify small trades, and measure order imbalance, the results of the two papers are quite consistent. Regardless of the measure or methods used, the two papers document strong reversals at long horizons (e.g., one year) and strong continuations at short horizons (e.g., one week). At a one month horizon, the results differ slightly but are easily reconciled. The PB measure of BOZ (2006) yields no reliable return patterns at a one month horizon, while the SSTT measure of Hvidkjaer (2006) yields reversals. Auxiliary analyses reveal that PB also yields reversals at a one month horizon for stocks with high levels of small trade turnover.

References

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Table 1: Monthly Percentage Abnormal Returns for Value-Weighted Portfolios formed on the basis of Weekly Proportion Buyer-Initiated Trades (PB) and Weekly Signed Small Trade Turnover (SSTT) using Small and Large Trades: February 1983 to December 2000

Portfolios are formed on Wednesday of each week, 1/4/1983 to 12/27/2000, based on quintiles of weekly measures of PB (proportion buyer-initiated trades using methods of BOZ) and SSTT (signed small trade turnover using methods of Hvidkjaer) calculated using small trades or large trades. In Panel A, positions are taken the first day of the ranking period and held for the ranking period (i.e., one week). In Panel B, positions are taken the day after ranking and held for one week (five trading days). The daily returns of portfolios are compounded to yield a monthly return series. Four-factor alphas are the intercepts from the time-series regressions of the monthly excess portfolio return on factors related to the market, size, book-to-market (value/growth), and momentum.

	SSTT (Signed Small Trade Turnover)						PB (Proportion Buys)					
	Return / Coefficient			t-statistic			Return / Coefficient			t-statistic		
Order Imbalance Quintile	Small Trades	Large Trades	Diff.	Small Trades	Large Trades	Diff.	Small Trades	Large Trades	Diff.	Small Trades	Large Trades	Diff.
	Panel A: Contemporaneous Returns						Panel A: Contemporaneous Returns					
1 (Sold)	-2.504	-10.479	7.975	-5.69	-26.96	24.85	-2.398	-7.398	5.000	-9.79	-38.96	28.26
2	-1.423	-6.207	4.784	-5.21	-22.96	28.92	-1.205	-5.718	4.513	-6.57	-29.36	27.03
3	-0.156	-3.304	3.148	-1.46	-16.99	18.36	-0.422	-1.091	0.668	-3.37	-11.73	4.46
4	0.578	1.587	-1.010	6.60	20.12	-8.97	0.413	4.111	-3.698	4.20	31.91	-25.73
5 (Bought)	3.419	9.331	-5.912	9.26	35.73	-20.66	1.786	8.062	-6.277	10.92	35.87	-27.95
B-S (5-1)	5.923	19.810	-13.887	8.05	32.34	-25.86	4.184	15.460	-11.277	11.99	39.37	-37.91
	Panel B: Subsequent Returns						Panel B: Subsequent Returns					
1 (Sold)	-0.296	0.717	-1.013	-1.50	4.43	-4.40	-0.637	0.421	-1.057	-5.16	3.57	-6.34
2	-0.278	0.479	-0.757	-2.41	5.15	-7.08	-0.160	0.797	-0.958	-1.87	8.06	-7.35
3	-0.132	-0.067	-0.065	-1.75	-0.72	-0.55	0.161	0.276	-0.115	1.70	3.53	-0.88
4	0.384	-0.081	0.465	5.55	-1.28	5.02	0.427	-0.219	0.646	4.81	-2.79	5.61
5 (Bought)	0.719	-0.185	0.904	4.85	-2.07	6.70	0.733	-0.362	1.095	5.22	-3.96	7.37
B-S (5-1)	1.015	-0.902	1.917	4.43	-4.55	6.91	1.370	-0.782	2.152	6.55	-5.54	8.26

Table 2: Monthly Percentage Abnormal Returns for Value-Weighted Portfolios formed on the basis of monthly Signed Small Trade Turnover (Panel A) and monthly Proportion Buyer-Initiated Small Trades (Panel B). Portfolios are formed each month, January 1983 to December 2000, based on quintiles of monthly measures of SSTT or PB. Portfolios are reconstituted monthly. The table presents intercepts from a time-series regressions of portfolio excess return (raw return less riskfree) on four factors: market, size, value, and momentum.

Panel A: SSTT (Signed Small Trade Turnover)

	Monthly Four-Factor Alphas (%)				*t-statistics*			
		Small Trade Turnover Partitions				Small Trade Turnover Partitions		
Order Imbalance Quintile	All Stocks	Low	Medium	High	All Stocks	Low	Medium	High
1 (Sold)	0.429	-0.031	0.168	0.768	2.58	-0.23	1.02	3.15
2	0.270	0.014	0.123	0.373	2.40	0.11	1.01	1.85
3	-0.025	-0.224	0.106	0.323	-0.36	-1.56	1.15	1.68
4	0.130	0.076	0.250	0.084	1.90	0.66	2.43	0.48
5 (Bought)	-0.021	-0.002	0.120	-0.613	-0.17	-0.01	0.90	-2.71
B-S (5-1)	-0.450	0.029	-0.048	-1.381	-1.98	0.15	-0.20	-4.57

Panel B: PB (Proportion Buys)

	Monthly Four-Factor Alphas (%)				*t-statistics*			
		Small Trade Turnover Partitions				Small Trade Turnover Partitions		
Order Imbalance Quintile	All Stocks	Low	Medium	High	All Stocks	Low	Medium	High
1 (Sold)	0.049	-0.187	0.227	0.959	0.42	-1.26	1.38	2.77
2	0.176	0.068	0.478	0.581	1.88	0.64	2.89	1.85
3	0.022	-0.008	0.201	-0.126	0.24	-0.07	1.40	-0.50
4	0.087	0.113	0.162	-0.424	1.01	1.00	1.12	-1.72
5 (Bought)	0.040	0.083	0.226	-0.575	0.37	0.65	1.41	-1.99
B-S (5-1)	-0.009	0.270	-0.001	-1.535	-0.05	1.37	0.00	-3.69

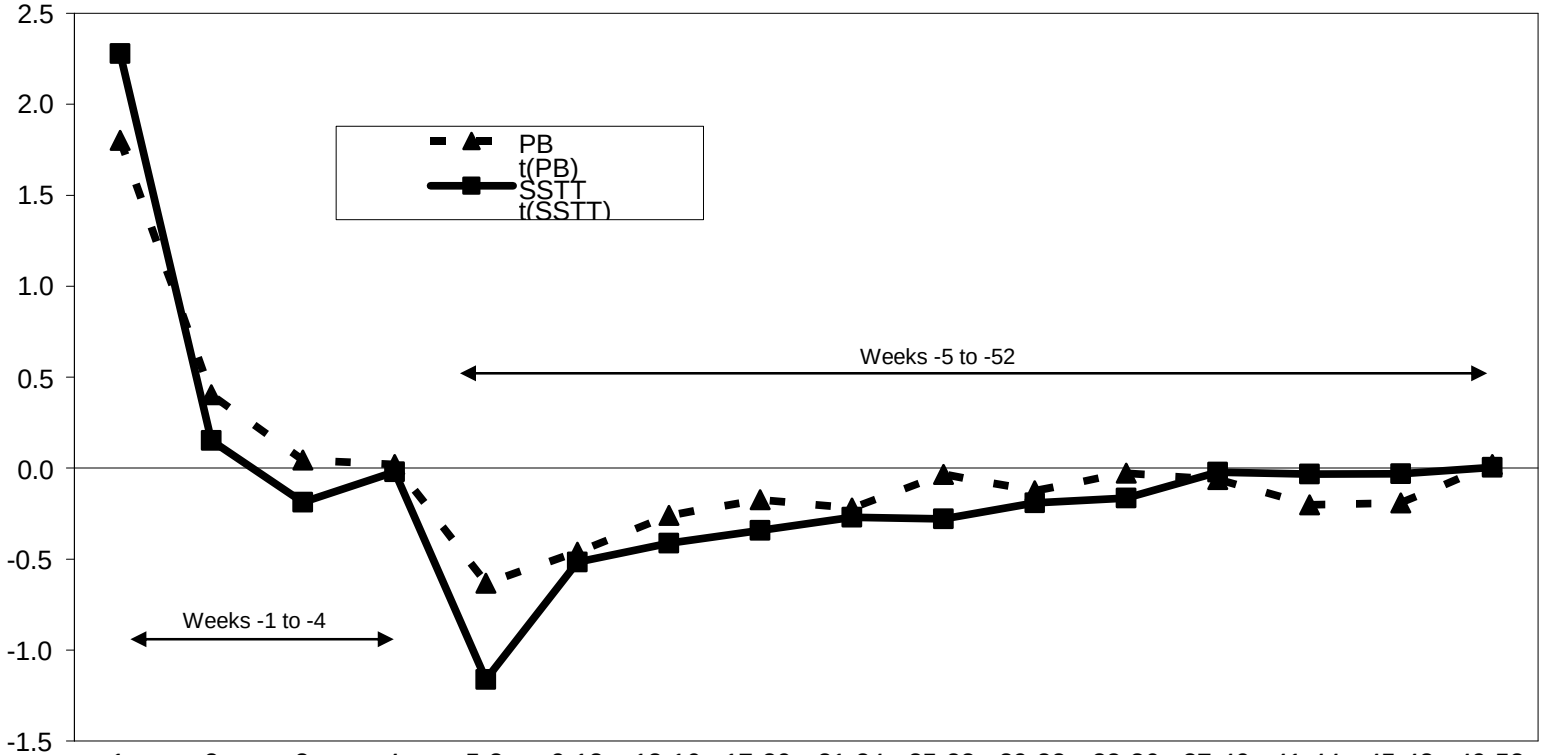
Figure 1: The Effect of Past Small Trade Order Imbalance on Weekly Returns 1984 to 2000

The following cross-sectional regression is estimated in each week from 1/4/84 through 12/27/00:

$$r_t = a + \sum_{w=1}^{4} b_w PB_{t-w} + \sum_{w=5}^{49\,by\,4} c_{t-w-3,t-w} PB_{t-w-3,t-w} + dBM + eMVE + \sum_{w=1}^{4} f_w r_{t-w} + gr_{t-52,t-5} + \varepsilon,$$

where r (dependent variable) is the percentage log return for a firm in week t. Independent variables include: OI, order imbalance measure – either proportion buys (PB) or signed small trade turnover (SSTT) (where lags are included for the past year); *BM*, book-to-market ratio; *MVE*, log of market value of equity; r, lags of weekly returns (percentage log returns for four weeks leading up to week t and the compound return from week t-52 to t-5). The figure presents the mean coefficient estimates across weeks on the order imbalance variables. Test statistics are based on the time-series mean and standard deviation of coefficient estimates.

Figure 1 cont'd



	1	2	3	4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	41-44	45-48	49-52
PB	1.802	0.404	0.045	0.020	-0.633	-0.462	-0.261	-0.174	-0.219	-0.034	-0.125	-0.028	-0.063	-0.202	-0.191	0.020
t(PB)	29.97	6.45	0.73	0.32	-6.46	-5.32	-2.98	-1.90	-2.43	-0.39	-1.40	-0.33	-0.74	-2.36	-2.28	0.25
SSTT	2.278	0.151	-0.188	-0.021	-1.162	-0.517	-0.413	-0.342	-0.271	-0.279	-0.192	-0.166	-0.023	-0.034	-0.030	0.004
t(SSTT)	13.77	1.02	-1.37	-0.14	-5.29	-2.57	-2.07	-1.85	-1.42	-1.49	-1.03	-1.00	-0.13	-0.19	-0.18	0.02